



SECTION 8: FIRE FIGHTING SYSTEM

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1 GENERAL

1.1 Codes and Standards

1 The following standards are referred to in this Part:

ANSI B16.1 Cast iron pipe flanges and flanged fittings
 ANSI B16.5 Pipe flanges and flanged fittings
 ASTM A 47 Specification for Ferritic Malleable Iron Castings
 ASTM A 106 Specification for Seamless Carbon Steel Pipe for High-Temperature Service
 ASTM A 135 Specification for Electric-Resistant-Welded Steel pipe
 ASTM A 183 Specification for Carbon Steel track Bolts and Nuts
 ASTM A 197 Specification for Cupola Malleable Iron
 ASTM A 234 Specification for Pipe Fittings of Wrought Carbon Steel and Alloy for Moderate and Elevated temperatures
 ASTM A 395 Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures
 ASTM A 536 Ductile Iron Castings
 BS 750 Underground fire hydrants and surface box frames and covers
 BS 1452 Specification for grey iron castings
 BS 2789 Iron castings with spheroidal or nodular graphite
 BS 5163 Double flanged cast iron wedge gate valves for waterworks purposes
 BS 5423 Portable fire extinguishers
 BS 6575 Fire blankets
 BS EN 671 Fixed fire-fighting systems - Hose systems
 NFPA 13 Installations of Sprinkler Systems

2 In addition to the above, all aspects of the fire fighting system shall comply with applicable national and international codes and standards including, but not limited to, those issued by the following organizations:

- (a) Civil Defense Department
- (b) National Fire Prevention Association (NFPA)
- (c) British Standards (BS)
- (d) Loss prevention Council Board (LPCB)

2 SPRINKLER SYSTEMS

2.1 System Description

1 Wet pipe sprinkler systems shall employ automatic sprinklers attached to a piping system containing water and connected to a water supply.

Each pipeline in the system shall be fully pressurized, so that water discharges immediately from sprinklers opened by a fire.

2 The system shall be designed that only those sprinklers that have been activated by heat will discharge water.

3 The design of the sprinkler system indicated on the Project Drawings is indicative only and is to be taken as general guide and not as final design unless specifically noted otherwise. The final detail design (including manufacturer components) shall be fully developed by the Contractor strictly in accordance with the requirements of the Civil Defense Department and the rules for automatic sprinkler installations in accordance with the relevant provisions of NFPA 13. The Contractor shall allow in his rates for components of sprinkler systems that are required to meet requirements but are not shown on the Project Drawings.

4 The fire fighting system shall be fed from a storage tank located inside the building or the basement of the building unless otherwise indicated in the Project Documentation.

5 The sprinkler system shall be complete with an automatic packaged fire pumping station and valves, water motor alarm and gong, pressurized water main with distribution pipe work, range pipes, hangers and supports, sprinkler heads and a piped drain system.

6 The alarm system shall be interconnected with the central fire alarm panel in order that the alarm bells and zone valves in various locations can be actuated.

7 The water motor alarm and gong should consist of a simple water turbine having the shaft connected to a rotary ball clapper mounted within a domed gong. The alarm system shall be self-winding, adjustable recycling non-thermal type and equipped with signal retarding device to prevent false alarms due to surges in the water system. Auxiliary pressure sensing devices shall be incorporated in the feed to the alarm gong to actuate the central fire alarm panel.

8 A test valve shall be incorporated on a branch pipe from the alarm valve to allow operational conditions to be simulated for test purposes. Water from the test valve shall be properly drained.

9 The distance between sprinklers shall not exceed 3.5 m. The maximum floor area to be covered by a single sprinkler for different hazard class is as follows:

(a) Ordinary hazard = 12 m²

(b) Extra light hazard = 21 m²

(c) Extra high hazard = 9 m²

10 The distance from the walls to the end sprinklers on the branch lines shall not exceed half of the allowable distance between sprinklers on the branch lines.

The distance from the walls to the end branch lines shall not exceed half the allowable distance between the branch lines.

11 The allowable distance between sprinklers on the branch lines is determined by the actual distance between the branch lines and the permissible protection area per sprinkler.

12 The Contractor shall install an adequate quantity of additional sprinkler heads of the correct temperature rating. The number will depend on the size of the installation and number of sprinkler heads likely to be opened. The following figures are the minimum number of additional sprinkler heads that should be installed:

(a) For systems not exceeding 300 sprinklers, 6 spare heads shall be installed

(b) For systems exceeding 300 sprinklers but not exceeding 1000, 12 spare heads shall be installed.

(c) For systems exceeding 1000 sprinklers, 24 spare heads shall be installed.

13 All components for sprinkler system packages should be from one single manufacturer with an approved local agent. The Contractor shall maintain a technical representative from the manufacturer or the local agent on site for the duration of the Contract in order to supervise the installation. This representative shall issue a certificate upon completion of the Project stating that the complete system has been installed, tested and commissioned in accordance with the Project Documentation, the requirements of the NFPA and the Civil Defense Department.

2.2 Sprinkler Heads

1 The glass bulb sprinkler heads should be of the pendant type and rated for 68^oC. They shall be arranged such that there is no interference with the discharge pattern and they shall be positioned between 75 and 150 mm below ceilings.

2 The sprinklers and pipelines shall not be spaced too close together in order to prevent an operating sprinkler from wetting, and thereby delaying the operation of, adjacent sprinklers.

3 In locations where sprinkler heads are liable to be operated or damaged by accidental blow, they should be protected by stout metal guards. Care shall be taken to ensure that the normal operation of the sprinkler head in the event of a fire is not impeded by such guards.

4 Sprinklers in false ceilings areas shall be the concealed or recessed type. They shall be the two-piece design with closure and mounting plate which allows for easy installation and removal.

5 Sprinklers in parking and hardware areas shall be the pendant or upright bulb type with a 12 mm diameter orifice and temperature rated to 68°C with a natural brass finishes and sprinkler guard.

2.3 Sprinkler System Alarm Devices

The system shall be provided with alarm devices consisting of, but not limited to, the items described in the following clauses.

2.4 Alarm Valve

Alarm valves shall be UL listed and FM approved. They shall be check type, with a rubber faced clapper, designed for use in wet pipe systems for automatic actuation. The alarm valve may be installed vertically or horizontally with inlet and outlet connection in accordance with the relevant provisions of ANSI B 16.1.

2.5 Basic Trip and Retarding Chamber

Basic trip and retarding chamber shall be UL listed and FM approved. It shall be used in order to prevent any false alarm that may be caused by small variation in pressure. The chamber should consist of a by-pass check valve to permit slow as well as small transient increases in water supply pressure to be passed through to the system and held at their highest value, without opening of the water way clapper.

2.6 Pressure Alarm Switches

Pressure alarm switches shall be UL listed and FM approved. They shall be designed to indicate a water discharge from automatic sprinkler and the start- up or shut down of auxiliary fire protection system equipment.

The one single pole double throw snap-action switch's components shall be enclosed in an oil resistant NEMA Type 2 drip proof indoor rated casing.

2.7 Water Motor Alarms

Water motor alarms shall be UL listed and FM approved. They shall be hydraulically operated outdoor alarms, designed for use with fire protection system water flow detection devices. They shall be suitable for mounting to any type of rigid wall and to consist of an approved "Y" strainer for use in the alarm line utilizing a high-energy efficient, lightweight, impeller design which can produce a very high sound pressure level. The gong, gong mount, and water motor casing shall be made with corrosion resistant aluminum alloy. The drive shall be of the type that does not require lubrication.

2.8 Stop Valves

Stop valves shall be UL listed and FM approved. They should be the gate valve type, designed specifically for fire line applications, where a positive indication of the open or closed position is necessary. The valve shall have flanged ends, an iron body and a working pressure of 12 bar.

2.9 Zoning Valve

Zoning valves shall be UL listed and FM approved. They shall be gear-operated butterfly valves with internal or external monitor switch. They shall have a wafer or lug style body for mounting between ANSI 125/150 flanges. They shall be rated for a 12 bar operating pressure and have a cast iron body and an EPDM seat with bronze disc.

2.10 Water Flow Detectors

Water flow detectors shall be UL listed and FM approved and shall be designed for use with wet pipe, automatic sprinkler systems. They shall utilize a vane type sensor to actuate two (2) single pole double throw snap-action switches when water flows at a sustained rate of 17.5 liters or more. They shall be used where sectional water flow signals are required.

2.11 Drain and Test Orifice

The system shall incorporate a 30 mm drain and a 13 mm test orifice for flow control inspection testing and drainage of feed mains.

3 WATER SUPPLY

3.1 General

1 Unless otherwise stated elsewhere in the Project Documentation, the water supply shall consist of:

- (a) electric motor driven fire pump with back-up
- (b) diesel motor driven fire pump with back-up

2 The capacity of the reservoirs from which fire fighting systems draw water shall be as stated in the Project Documentation.

4 HOSE REELS AND HOSES

4.1 General

1 Hose reels and hoses shall be installed in locations as stated in the Project Documentation unless otherwise directed by the Civil Defense Department.

2 Fire hose reel assemblies shall be provided with full operational instructions for display on or adjacent to the hose reel.

3 The supplier shall make available an installation and maintenance manual for the hose reel.

4 All hose systems shall be such that they can be operated efficiently by one person and that such system shall have a long service life and will not need excessive maintenance.

5 Hose reels shall be marked with the following information:

- (a) Suppliers name or trademark, or both
- (b) Year of manufacture
- (c) Maximum working pressure
- (d) Length and bore of hose
- (e) Nozzle diameter (marked on the nozzle)

4.2 Cabinets

1 Cabinets shall be fitted with a door. The door shall open approximately 180° to allow the hose to run at freely in any direction.

2 Cabinets shall have suitable ventilation openings.

3 Cabinets shall be fitted with a lock if required by the Project Documentation. Lockable cabinets shall be fitted with an emergency opening device.

4 To provide access for inspection and maintenance, the cabinet shall be unlock able with a key or a special opening device. Lockable cabinets shall have provision for a security seal to be fitted.

4.3 Hose Reels with Semi-Rigid Hose

1 Hose reels with semi-rigid hose shall generally comply with BS EN 671-1.

2 The nominal bore of the hose shall be 19 mm or 25 mm or 33 mm.

3 The maximum length of the hose shall not exceed 30 m.

4 The reel shall rotate around a spindle. The reel shall consist of two wheel discs with a maximum diameter not more than 800 mm, and inside segments or drum with a minimum diameter not less than 200 mm for 19 mm and 25 mm hose and minimum diameter not less than 280 mm for 33 mm hose. The discs shall be red in color.

5 The hose shall terminate in a shut-off nozzle which shall give the following control settings:

- (a) shut
- (b) spray (sheet or conical) and/or jet.

6 Rotary operated nozzles shall be marked to show the direction of closing and opening. Lever operated nozzles shall be marked to show the setting for:

- (a) Shut
- (b) Spray and/or jet.

7 A manual or automatic inlet stop valve shall be fitted to each hose reel.

8 Working, test and minimum burst pressure for hose reels shall be as given in the next Table, unless otherwise stated in the Project Documentation or agreed with the Engineer.

Pressure for Hose Reels

Nominal Diameter (mm)	Working Pressure (bar)	Test Pressure (bar)	Minimum Burst Pressure (bar)
19	12	18	30
25	12	18	30
33	7	10.5	17.5

9 Testing, performance and materials of hose reels with semi-rigid hose shall comply with the relevant provisions of BS EN 671-1.

4.4 Hose Systems with Lay-flat Hose

1 Hose systems with lay-flat hose shall generally comply with BS EN 671-2.

2 The hose system shall be designed for mounting in one of the following forms:

- (a) In a wall recess with cover
- (b) In a cabinet in a wall recess
- (c) In a cabinet for surface mounting

3 The hose support shall be one of the following types:

- (a) Type 1: rotating reel
 - (b) Type 2: cradle with the hose double coiled
 - (c) Type 3: hose basket with the hose flaked
- 4 With Type 1 hose supports, the reel shall rotate around a spindle so that the hose can be withdrawn freely.

4 The inside drum shall have a minimum diameter of not less than 70 mm and shall have a slit not less than 20 mm wide across the full diameter of the drum into which the folded house is located.

- (a) Type 1: rotating reel
 - (b) Type 2: cradle with the hose double coiled
 - (c) Type 3: hose basket with the hose flaked
- 4 With Type 1 hose supports, the reel shall rotate around a spindle so that the hose can be withdrawn freely. The inside drum shall have a minimum diameter of not less than 70 mm and shall have a slit not less than 20 mm wide across the full diameter of the drum into which the folded house is located.

5 Type 1 and 3 supports, if fixed to the cabinet, shall allow a swing to a position at 90 to the plane of the back of the cabinet. The turning axis shall be vertical.

6 The hose shall be lay-flat, with a nominal bore of 52 mm, and shall not exceed 20 m in length.

7 A coupling shall be used to connect the hose to the valve and to the shut-off nozzle. The coupling shall be bound to the hose by means of an even pressure over the complete perimeter of the hose against the coupling shank.

8 The hose shall terminate in a shut-off nozzle, which shall give the following control settings:

- (a) shut
- (b) spray (sheet or conical) and/or jet.

9 Rotary operated nozzles shall be marked to show the direction of closing and opening. Lever operated nozzles shall be marked to show the setting for:

- (a) shut
- (b) spray and/or jet.

10 A manual inlet stop valve shall be fitted to the hose system. The valve shall be screw down or other slow-opening type. The inlet and outlet of the valve shall form an angle of not less than 90_ and not more than 135_

11 Hose assemblies shall be designed for the following pressures unless otherwise stated in the project documentation or agreed with the Engineer:

- (a) maximum working pressure shall be 12 bar
- (b) test pressure shall be 24 bar
- (c) minimum burst pressure shall be 42 bar

12 Testing, performance and materials of hose systems with lay-flat hose shall comply with the relevant provisions of BS EN 671-2.

5 FIRE HYDRANTS

5.1 General

1 Fire hydrants shall be installed in locations as stated in the Project Documentation unless otherwise directed by the Civil Defense Department.

2 A certificate shall be obtained from the manufacturer stating that the fire hydrants to be supplied are suitable for use in Oman.

3 Fire hydrants shall be installed in accordance with the manufacturer's instructions.

5.2 High Pressure Dry Barrel Hydrant

1 High pressure dry barrel hydrants shall come complete with removable/replaceable nozzles and hydrant seat, top stop nut, easily repaired traffic section, nozzle section with 360° rotation, main valve opening and bronze drain plug.

2 Working pressure of the hydrant shall be 14 bars and the testing pressure shall be 28 bars unless otherwise stated in the Project Documentation or agreed with the Engineer.

3 The hydrant shall comply with ASNI/AWWA C502 and shall be UL listed and FM approved.

4 Materials for the hydrants shall be as follows:

- (a) Nozzle section, barrels, stand pipe flanges, breakable flange, base, main valve flange, weather-shield operating nut and bonnet all shall be ductile iron
- (b) Main valve disc shall be ductile iron core and fully encapsulated in EPDM rubber
- (c) Caps shall be cast iron
- (d) Coating above ground shall be fusion bonded epoxy inside and out
- (e) Coating below ground shall be bitumen or fusion bonded epoxy
- (f) Nozzles, valve seat ring, drain ring, drain bushings and plugs, stem nut, stem bushing and thrust nut shall be bronze
- (g) Stop nut, cap chain, bolts and nuts shall be zinc plated steel
- (h) Stem rod coupling, standpipe lock rings, nozzle lock screw, lock plate, lock plate screw and spider bolt shall be stainless steel
- (i) Barrel gaskets and cap gaskets shall be nitrile rubber.

5 Each hydrant shall be clearly marked, either integrally with the stated components or on a plate of durable material securely fixed to that component, as follows:

- (a) The number of the standard to which the hydrant conforms and the date of the standard
- (b) The manufacturer's name or trademark
- (c) The identification number (the reference used by the manufacturer allowing identification for the supply of spares, etc).

5.3 Underground Fire Hydrants and Surface Box Frames and Covers

1 Underground fire hydrants and surface box frames and covers shall generally comply with the requirements of BS 750.

2 Underground fire hydrants with wedge gate type or screw down type valves shall be suitable for a maximum working pressure of 16 bar.

3 Fire hydrants shall be of the wedge gate type or screw-down type.

4 The wedge gate valve shall comply with the requirements of BS 5163 for PN 16 valves. The associated duck foot bends shall be grey cast iron (CI) to BS 1452 or spheroidal graphite cast iron (SG) to BS 2789.

5 Materials and testing of underground fire hydraulic shall be to BS 750. Provision shall be made for a certificate to be made available which certifies that the hydrant has complied with all testing requirements of BS 750.

6 Each screw-down type hydrant and each duck foot bend on a wedge gate type hydrant shall be provided with a drain boss on the outlet side. It shall be located at the lowest practicable point.

7 The hydrants shall have screwed outlets. The screwed outlet shall be provided with a cap to cover the outlet thread. It shall be securely attached to the hydrant by a chain or other flexible device.

8 When fitted with a standard round thread outlet, the hydrant shall deliver not less than 2000 liters/minute at a constant pressure of 1.7 bars at the inlet to the hydrant.

9 The hydrant-operating spindle shall be provided with a cast iron cap complying with the requirements of BS 5163. The cap shall be securely fixed to the spindle so that it remains fixed in position during normal use.

10 Each hydrant valve, duck foot bend and outlet shall be clearly marked, either integrally with the stated components or on a plate of durable material securely fixed to that component, as follows:

(a) On wedge gate type hydrant valves:

(i) In addition to the marking requirements of BS 5163, the direction of valve opening on the gland or upper part of the hydrant.

(b) on duck foot bends:

(i) The number of the standard to which the hydrant conforms (i.e. BS 750) and the date of the standard

(ii) The material designation of the body, for grey cast iron 'CI', or for spheroidal graphite cast iron 'SG'

(c) On screw-down type hydrants:

(i) The number of the standard to which the hydrant conforms (i.e. BS 750) and the date of the standard

(ii) The material designation of the body, for grey cast iron 'CI', or for spheroidal graphite cast iron 'SG'

- (iii) The direction of valve opening on the gland or upper part of the hydrant
- (iv) If loose valve mark 'LV' or "Loose'
- (v) The manufacturer's name or trademark
- (vi) The identification number (the reference used by the manufacturer allowing identification for the supply of spares, etc)
- (d) On screwed outlets:
 - (i) The number of the standard to which the hydrant conforms (i.e. BS 750) and the date of the standard.

11 Class, type, manufacture, workmanship, coating and design features of surface box covers and frames shall be in accordance with BS 750.

12 Surface box covers and frames shall be tested in accordance with the relevant provisions of BS 750. Provision shall be made for a certificate to be made available which certifies that samples from each production lot from which the delivery is made up comply with the requirements of BS 750.

13 Surface box covers shall be clearly marked by having the words "FIRE HYDRANT" in letters not less than 30 mm high, in English and Arabic, cast into the cover. The cover and frame shall have clearly cast thereon the following:

- (i) The number of the standard to which the hydrant conforms (i.e. BS 750)
- (ii) The date of the standard
- (iii) The grade of the cover and frame.

6 PIPES AND FITTINGS

6.1 General

1 Pipes shall be UL listed and FM approved. They shall be exterior galvanized steel to ASTM A 135 with a working pressure of 14.5 bars. Couplings may be of the rolled groove type or the mechanical locking type (push-on). Pipe end preparation for the mechanical locking type couplings will be in accordance with the manufacturer's recommendations.

2 Fittings shall be UL listed and FM approved. Mechanical grooved pipe couplings and fittings as manufactured by specialized manufacturers shall be used for all standpipe systems.

- (a) Couplings shall be ductile iron to ASTM A 536, or malleable iron to ASTM A 47, with chlorinated butyl gaskets suitable for an operating temperature of 95°C and heat treated carbon steel bolts and nuts to ASTM A 183.

(b) Fittings shall be malleable iron to ASTM A 47 or ductile iron to ASTM A 536 with grooved or shouldered ends.

(c) flanges shall be malleable iron to ASTM A 47 or ductile iron to ASTM A 536, with a hinged, two-piece design, suitable for opening and engaging the grooves, and shall be secured in position with a tight-fitting lock bolt. Cast iron flanges shall comply with ANSI B.16.1 and steel flanges steel shall comply with ANSI B 16.5.

(d) Valves shall be grooved end design with encapsulated body and disc. Neck design shall readily accommodate insulation. Valves shall have pressure assisted double seal and be capable of 12 bar bubble tight shutoff. Butterfly valves shall be with gear actuator.

6.2 Hangers Supports Anchors and Guide

1 The pipe work shall be supported, anchored and guided in order to preclude failure or deformation. The Contractor shall construct and install hangers, supports, anchors, guides and accessories as necessary to the approval of the Engineer. Supports shall be designed to support the weight of the pipe, the weight of fluid and the weight of pipe insulation.

2 Piping shall be securely fastened to the structure without over- stressing any portion of the structure itself. Pipe supports, anchors and guides shall be secured to concrete by means of inserts or if greater load carrying capacity is required by means of steel fishplates embedded in the concrete.

3 Hanger shall be arrange so as to prevent transmission of vibration from piping to building and supports.

4 Pipe hangers and supports shall be furnished complete with rods, bolts, lock, nuts, swivels couplings, brackets and all other components and accessories to allow installation to freely expand and contract.

5 Hangers spacing shall be such that the piping is installed without undue strains and stresses and provision shall be made for expansion, contraction, structural settlement and water- hammer.

6 Supports, clamps and hangers shall be made of galvanized steel, fixed with drilled plugs.

7 PUMPS

7.1 General

1 Furnish and install where shown on the drawings one LPCB listed single stage or multistage centrifugal fire pump complete with motor, control, fittings, jockey pump and specialty accessories necessary to complete the installation in every respect. The complete installation shall be in accordance with the requirements of, and meet with the approval of, the Civil Defense Department and any other authorities having jurisdiction. Centrifugal fire pumps shall have a horizontal shaft with electric motor drive. Jockey fire pumps shall have electric motor drives.

2 Pumps serving water supply to fire fighting system are normally driven electrically or by a compression ignition engine and should always be arranged to start automatically in the event of system operation. In addition, arrangement for starting manually should be also be installed. It is important that the electricity supply should always be maintained to the pumping set. It is therefore essential that the electrical connections be such that a power supply is always available for the motor when the switches for the distribution of electrical power throughout the building are cut. Any switches on the power feed to the motor should be clearly labelled, "FIRE PUMP MOTOR SUPPLY - NOT TO BE SWITCHED OFF IN THE EVENT OF FIRE". Such switches should be of the locking type and should be kept locked on. An indicator lamp should be provided to show continuously that full power supply is available for the motor. Any fuses in the electricity sub-circuit should be of the high rupturing capacity (HRC) type.

7.2 Horizontal Fire Pumps

1 Pumps shall be horizontal fire pumps as indicated, factory assembled and tested. The capacity and electrical characteristics shall be as detailed elsewhere in the Project Documentation.

2 The pumps shall be capable of delivering not less than 150% of the rated flow at not less than 65% the rated head.

3 Pumps shall be hydrostatically tested at the factory and run tested pump prior to shipment. The hydrostatic test shall be at 150% of shut off head plus suction head but shall not less than 1725 kPa.

4 The pump shall meet or exceed 75% efficiency at design point.

7.3 Construction

1 Pump shall have cast-iron casing with suction and discharge flanges machined to ANSI B16.1 dimensions, of size and pressure rating detailed in the Project Documentation with a red paint finish.

2 Each pump shall be capable of continuous operation without producing noise in excess of hydraulic institute and OSHA guidelines.

3 Pump casing shall be close grain cast iron with a replaceable bronze case wear ring. The pumps shall be of the back pull out design so that the rotating element can be removed from the casing without disconnecting the suction or discharge piping. Full flange connections shall be integrally cast with the volute. Pump impeller shall be of cast bronze material and shall be statically and dynamically balanced. Impeller diameter shall be trimmed for the specified design conditions.

4 The pump shall be mounted on a heavy duty CI bearing frame.

5 The shaft shall be of stainless steel.

6 The pump bearing shall be of the permanently sealed type requiring no external lubrication.

7 The pump shall be connected to drive motor by a flexible coupling capable of withstanding all torsional, radial and axial loads.

7.4 Fittings

The Contractor shall provide the following accessory fittings:

- (a) Eccentric tapered suction reducer
- (b) Concentric tapered discharge reducer
- (c) Hose valve test head
- (d) Hose valve with caps and chains.
- (e) pumps casing relief valve
- (f) Ball drip valve
- (g) Suction and discharge pressure gages
- (h) Mains relief valve
- (i) Strainer (waste cone)

7.5 Electric Motors

Electric motors for pumps shall be horizontal, foot mounted, ball bearing, induction motor with open drip-proof NEMA enclosure. The motor shall be mounted on the same steel base as the pump and connected to the pump with a flexible coupling. The coupling shall be protected by a coupling guard. The pump and motor shaft shall be aligned prior to shipment. The pump motor current will not exceed the full load ampere rating under any conditions of pump load. Pump motor shall be suitable for 415/3/50 and 2900 RPM, class "F" insulation, 50°C ambient temperature indoor.

7.6 Controller and Transfer Switch

1 The controller and transfer switch shall be LPCB listed and shall be the combined manual and automatic, across the line type. Control equipment shall be furnished in a steel mounted, drip proof enclosure with front operated circuit breaker and disconnect switch.

2 The circuit breaker shall be rated as approved for continued use.

3 The pressure regulator shall have a range of 0 to 2070 kPa with pressure settings, established at time of testing at the Site. An instantaneous recycling running period timer to prevent to frequent automatic starting of fire pump motor, set to keep the motor in operation for 6 minutes on automatic start, shall be interwired with the pressure regulator.

4 The controller shall be capable of interrupting a short circuit current at least equal to the short circuit current in the controller supply circuit.

7.7 Alarm Panel

1 An alarm panel with visible and audible signals for indication for FIRE PUMP CURRENT FAILURE and PUMP OPERATING shall be installed and connected to the fire pump controller.

7.8 Jockey Fire Pumps

1 Jockey pumps shall be factory assembled and tested with capacities and electrical characteristics as detailed in the Project Documentation.

2 Jockey pumps shall be constructed from with cast iron diffusers and adapter with registered fits to maintain axial alignment. They shall have bronze enclosed impellers, bronze casing rings, bronze base bearing, steel clamp type shaft coupling and stainless steel shaft. The impellers shall be pinned to the shaft to prevent reverse rotation damage and to maintain proper inter-stage lateral setting. They shall incorporate threaded suction and

discharge connections, mechanical seals and a cast-iron pump base with drain plug. They shall have a red paint finish.

3 The motor controller shall be LPCB listed and approved for fire pump service. Control shall include a combination type starter with fused disconnect switch, thermal over-current protection and a hand-off automatic selector switch in the enclosure. Control shall also include an adjustable pressure switch with gauge cock.

4 The installation shall come complete with a brass-cased pressure gauge with a 100 mm dial on the discharge pipe near jockey pump.

5 The installation shall come complete with a 20 mm relief valve on the discharge line of the jockey pump to relieve excess pressure to floor drains.

6 The installation shall come complete with a controller sensing pipes, not less than 15 mm in diameter with a 15 mm globe valve for testing mechanism of controller.

7 The installation shall come complete with an 85 mm diameter bronze check valves with 85 mm orifice in the clapper or ground-face unions with non-corrosive diaphragm with an 85 mm orifice.

8 The jockey pumps and pump drives shall be installed on vibration isolators in accordance with the manufacturer's recommendations.

7.9 Field Quality Control

Upon completion of installation the Contractor shall perform field acceptance tests to demonstrate that the fire protection pumps comply with requirements of the Project Documentation.

8 PORTABLE FIRE EXTINGUISHERS

8.1 General

1 Fire extinguishers shall conform with the relevant provisions of BS 5423.

2 Fire extinguishers shall be color coded according to their type. The color shall be as follows:

- (a) Red - water
- (b) Cream - foam
- (c) Black - carbon dioxide

- (d) Blue - dry powder
- (e) Green - halon

3 The types of extinguishers that can be used on a fire are dependent upon the class of the fire. The fire classes and the types of extinguishers that can be used on them is given in the following table. Final selection of extinguisher type shall be in accordance with and to the approval of the Civil Defense Department.

4 The capacity of fire extinguishers shall be as detailed in the Project Documentation.
Fire Class and Extinguisher Type

Tabl 1:1

Class	Nature	Example	Extinguisher Type
A	Carbonaceous	Wood, paper, textiles	Water
B	Flammable liquids	Adhesives Flammable liquid stores Bitumen Boilers, Petrol or Diesel powdered equipment Cooking Rang Fires	Dry Powder Dry powder of foam Dry powder foam, carbon dioxide or Halon Dry Powder, carbon dioxide or fire blanket
C	Flammable gases	Lpg, acetylene	Carbon dioxide, dry powder or halon.
D	Reactive metals	Magnesium, sodium etc.	Dry powder specially developed for particular metals
E	Electrical	Any material where there is a danger of live electricity	Carbon dioxide dry powder or halon.

9 FIRE BLANKETS

9.1 General

1 Fire blankets shall be manufactured from woven glass fabric coated on both sides with white silicon rubber, fully tested in accordance with BS 6575.

2 The blankets shall be supplied in white container suitable for wall mounting. Fire blankets shall be provided in the following standard sizes:

- (a) 1000 x 1000 mm
- (b) 1250 x 1250 mm
- (c) 1500 x 1250 mm
- (d) 1800 x 1250 mm
- (e) 1800 x 1800 mm

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